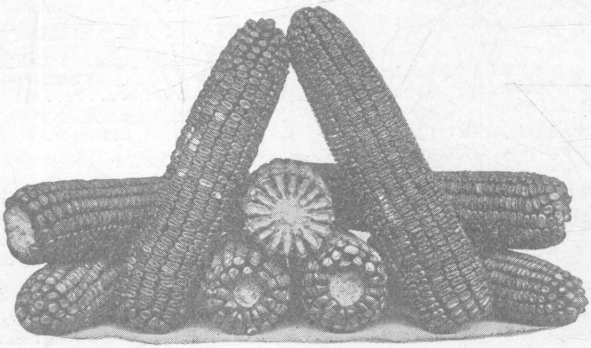
THE CORN CROP.

SELECTION OF SEED. DESCRIPTION OF VARIETIES.
HILL PLANTING VS. DRILLING. CULTIVATION.
VARIETY TEST.

OHIO
Agricultural Experiment Station

WOOSTER. OHIO, U. S. A., APRIL, 1903

BULLETIN 140



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BULLETIN

OF THE

Ohio Agricultural Experiment Station

NUMBER 140 APRIL, 1903

THE CORN CROP.

BY C. G. WILLIAMS.

Ohio is interested in corn as never before. Our area devoted to this crop mounts up to over 3,200,000 acres, and it is gradually increasing. Since the seventies we have added nearly a million acres. Our interest is perhaps the greater because we are awakening to the fact that our yield per acre is as gradually decreasing. The ten-year period, 1890-99, shows a falling off of 3.34 bushels per acre as compared with 1870-79.

That this has been due in a great measure to the decrease in our livestock industry and the consequent selling of our corn rather than feeding it upon the farm has been conclusively shown by Director Thorne in his extended treatment of this subject before the State Agricultural Convention held at Columbus in January, 1902, and published in the Ohio Agricultural Report for the year 1901.

The problem of fertility maintenance is a great one and lies at the foundation of the corn crop. We can hardly hope to grow corn year after year in continuous culture, selling the bulk of the crop to be fed elsewhere, and maintain even our present moderate yield per acre. The lesson from the best corn lands of Illinois is "That the yield from unmanured land continuously in corn is slowly but surely decreasing." (Bulletin 42, Illinois Experiment Station.)

The lesson from our much less satisfactory corn lands at Wooster gives increasing evidence of the necessity for rotation and the husbanding of fertility.

SELECTION OF SEED CORN.

After a fertile soil comes the consideration of seed. Ohio uses some 400,000 bushels of seed corn each year. Is there a chance for improvement in the matter of seed?

About the only distinction that many corn growers make in selecting seed corn is that of color. All corn is placed in two classes—white and yellow. This, and the matter of maturity, is all that is considered by many.

Maturity is of first importance. Upon maturity and subsequent curing depends the vitality of the seed, and upon the vitality of the seed depends the crop. It will prove a mistake to use seed testing less than 95 per cent vitality. In the selection of seed corn the matter of uniformity is of great importance. This applies to the size, shape and color of the ear and kernel; the arrangement, number and space between the rows; the indentation of the kernel; the filling out at butt and tip; the color and size of the cob.

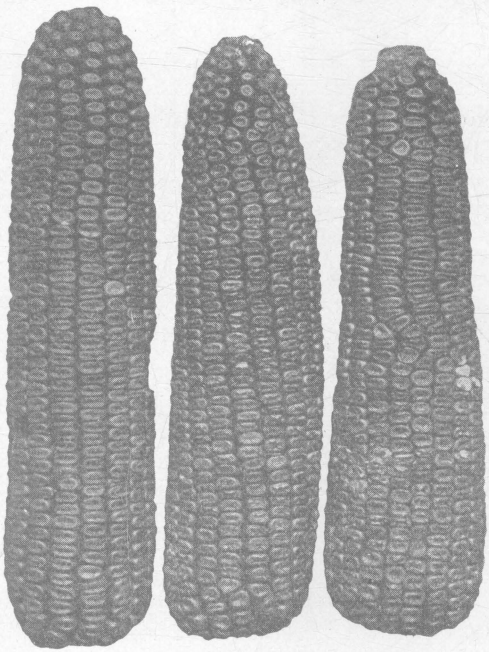

FIGURE I.

In Figure I are shown three different shapes of ears—the cylindrical, tapering and very tapering. The shape of the ear varies with the variety. The typical Leaming ear is a tapering ear. It is possible, however, to select these different shapes in all varieties. Just as possible as it is to select the beef and dairy form in the same breed of cattle, and by selection and breeding to fix these

types in both plant and animal. The slightly tapering ear is not especially objectionable, but since the tapering ear, if it have much taper, results from the dropping of a row or more of kernels, it means, of course, a smaller proportion of corn to cob. The closer we can keep to the cylindrical ear the greater the amount of corn the ear will carry.

The shape of the kernel has much to do with the amount of grain a given sized cob will carry. The preferable shape is the long or medium wedge. The circumference of an ear being two or three times greater than the circumference of the cob, it is obvious that the wedged-shaped kernel is the only kernel that will shell the maximum amount of corn.

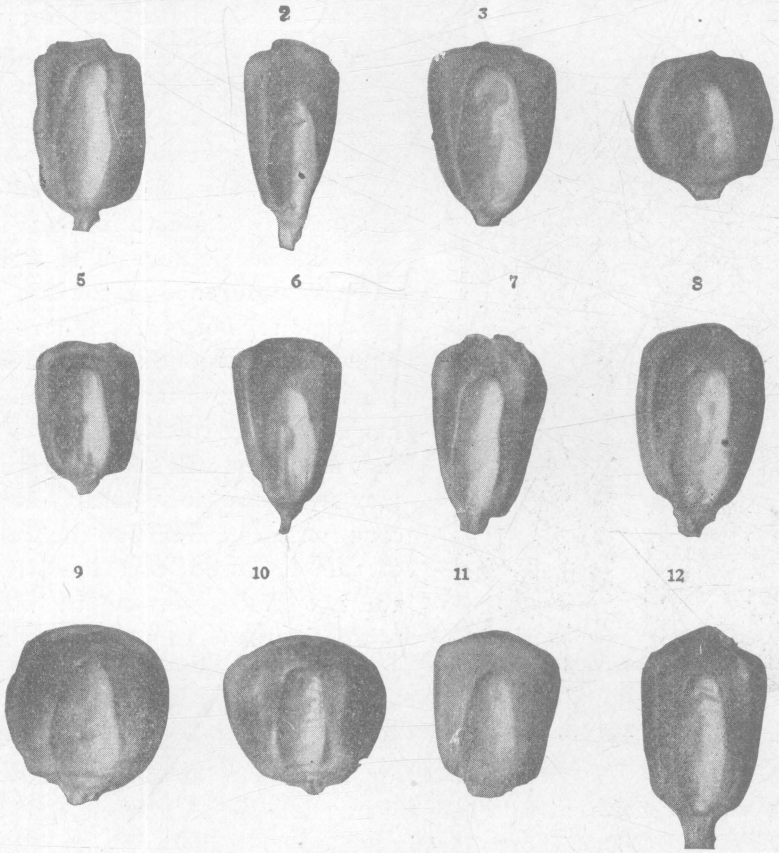

FIGURE II

Figure II shows several different types of kernels. The rectangular kernel with its broad base (Nos. 1, 4 and 11) means fewer rows and wider apart at the summit and of necessity a reduction in the percent of corn.

There is such a thing as too sharp a point. Such a kernel wastes space at the cob and restricts the size of the germ. Compare Nos. 2 and 3 and note the difference in the size of the germ. The large germ indicates higher feeding quality and greater vitality. No. 9 comes nearly being circular and indicates few rows with deep furrows between them. No. 5 is lacking in depth, though otherwise of fairly good shape. No. 10 is much too broad for its depth. The most desirable shapes are Nos 3, 6, 7, 8 and 12. These will permit of a goodly number of rows and will shell a higher percent of corn.

The number of rows to the ear and the furrows between the rows should be taken into consideration in the selection of seed. Fig. III shows two ears of Clarage, the one having twelve rows, the other twenty. In length they are the same. In circumference the 20-rowed ear measured one-fourth of an inch more than the other. The weihgt and circumference of the cob are the same for both ears. There is a difference of two ounces in the weight of shelled corn in favor of the ear having twenty rows. This is not very much you will say, and rightly. However, one acre of fifty-bushel corn means 4,533 ears of the weight of the 12-rowed ear; and if we add two ounces per ear by means of this increase in the number of rows per ear we shall have increased our yield by 8.3 bushels per acre. Or, taking the average yield for the State at 33 bushels per acre we will make, at this rate, an increase of 5.5 bushels, and this increase on 3,200,000 acres means 17,600,000 bushels of corn.

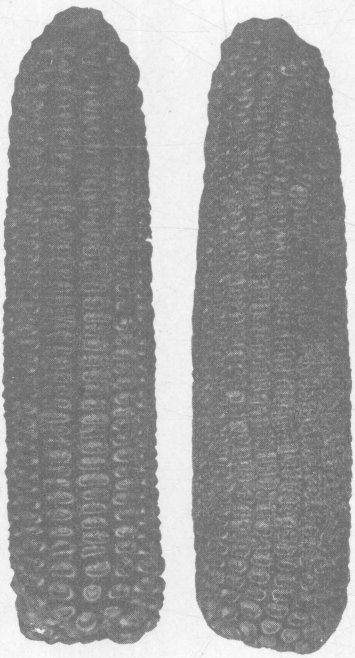

FIGURE III.

The well bred ear of corn has not only a goodly number of rows made up of wedge-shaped kernels of good length, but these rows, crowding the shank at the butt, should run parallel with the cob well to the tip, covering entirely the point of the cob. Fig, IV shows the proper arrangement of the rows, with two undesirable ears.

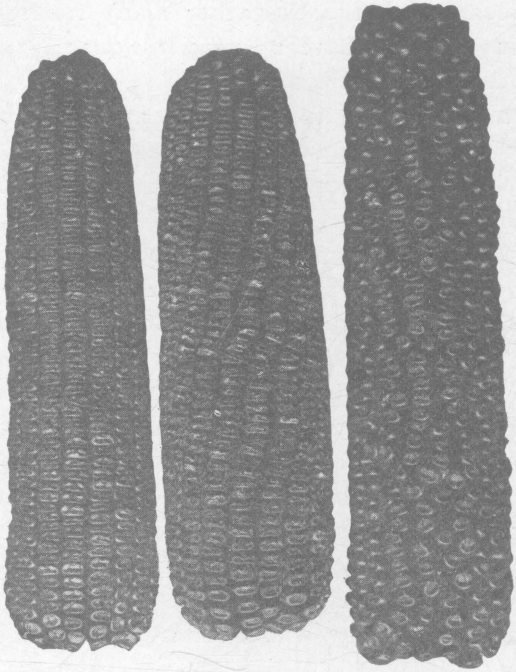

FIGURE IV

The question is often asked whether the butts and tips should be used for seed? So far as yield and quality of grain are considered, Prof. Hickman summarized nine years' experiments in Bulletin 78 as follows: "Repeated experiments show that neither the yield nor quality of the grain is materially affected by growing the crops from either the butt, middle or tip grains." They are objectionable however because of the impossibility of securing an even stand with kernels of irregular size. Recent chemical analysis of a composite sample of corn from tips, middles and butts of six ears, made by Mr. Ames, Chemist of the Station, shows .87 per cent less protein in the tip grains than in either the middle or butt grains. The middle and butt grains showed precisely the same per cent. This would seem to indicate that the practice of discarding butt and tip grains would not tend to depreciate the feeding value of corn. In the sample analyzed an inch and a half was shelled from both butt and tip.

In selecting corn for seed it is essential to keep these desirable characteristics in mind. It is hardly possible to take note of many of them except as the corn is husked.

It is the custom of many growers to select seed in the standing corn. Some desirable qualities can be looked to in selecting in this way. Notably early maturity, the weight of ear, the size of

shank; both the latter indicated by the hanging down of the ear. It will be necessary however to gather many times the amount of seed needed in order to have a sufficient quantity from which to select along other lines indicated.

Perhaps a better way is to select as the corn is husked, taking note of the size of stalk, position of ear, etc. An excess should be selected even then in order that it may be culled to a uniform type.

It will be found advantageous to grow a small field especially for seed, providing it can be isolated. The seed plot should have the best corn land the farm affords, and the best of care throughout, including the choicest of the seed. And when the corn begins to tassel one should go through the plot and remove the tassels from all barren and weak stalks, that a vigorous and productive parentage may be insured.

While it is perhaps true that the average farmer will not take the trouble to grow a choice quality of seed and is disposed to take the easier course of sending to the seedsman for it, it is to be feared that this course is a mistake, especially if he purchase seed in ignorance of where, how, and by whom it was grown, as is usually the case.

It is quite probable that home grown seed, even though it may not be bred quite so high, but thoroughly adapted to soil and climate, will give as good or better satisfaction than that shipped in from distances remote and soils dissimilar. Try the new varieties, but select, improve, breed up the best native varieties.

SELECTING FOR HIGHER PROTEIN.

The fact that corn is relatively deficient in protein and for this reason not a satisfactory food for young animals and milch cows, except as fed in connection with grain products much richer in protein; and the further fact that there is a wide difference in the per cent of protein in individual ears of corn, has led to an effort to improve the protein content of corn by selecting seed ears showing a higher per cent of protein than normal.

That this can be done has been proven quite conclusively by the Illinois Experiment Station in experiments reported in Bulletin 82 of that Station.

While individual ears differ in protein content, the kernels from a given ear are quite uniform. So much so that it is only necessary to analyze or examine a few kernels in order to approximate the quality of the ear.

Although a chemical analysis is necessary to determine the amount of protein with certainty, yet a careful examination of a few kernels of an ear will enable one, after a little practice, to pick out high and low protein ears with a high degree of certainty.

Following the method suggested by Dr. Hopkins, in the above mentioned bulletin, attention is called to the four principal parts of a kernel of corn:

The hull, or outer layer; the hard, flinty, darker colored part lying next to the hull and thickest in the middle portion of the kernel; the white, floury part lying in the crown and next to the germ; the germ occupying the central portion and extending from the tip well toward the crown.

The hard, flinty portion contains the larger proportion of the protein; the white, floury part is richer in carbohydrates and contains but a small part of the protein; The germ carries the greater part of oil and is also rich in protein.

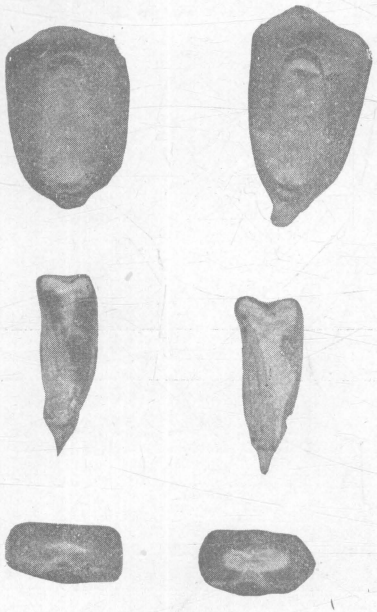

FIGURE V

The examination of a kernel of corn cut open with a knife, as shown in Fig. V, will enable one to distinguish these several parts and to note a great difference in kernels from different ears. Take several kernels from an ear: place them with germ up and cut part of them lengthwise and part crosswise of the germ.

The *relative proportion* of the flinty part as compared with the starchy part indicates high or low protein. The greater the proportion of the flinty part the higher the percent of protein.

The kernels to the left in Fig. V showed by chemical analysis 13.14 percent protein, while those to the right analyzed 8.34 per cent protein. Both ears were selected from the same variety and crib, the average run of which tested 9.97 percent protein.

Only a little experience is needed to enable one to pick out the high protein ears with some degree of accuracy. In order to test the possibility of doing this some four bushels of corn were examined by taking two to four kernels from each ear, cutting and esti-

mating the proportion of the flinty part as compared with the starchy part as described above, the object being to pick out the high protein ears. Fourteen ears were selected as being above the average in protein and four as being below. Table I shows the per centage of protein in each ear as afterward determined by chemical analysis.

CORN TABLE I.—SELECTED (MECHANICALLY) FOR HIGH AND LOW PROTEIN.

CORN SELECTED FOR			
HIGH PROTEIN.		LOW PROTEIN.	
Ear No.	PER CENT	Ear No.	PER CENT
1	11.56	50	10.07
2	11.28	51	8.34
3	13.12	52	10.32
4	11.28	53	10.07
5	10.24	*100	9.97
6	10.85		
7	11.44		
8	12.14		
9	11.87		
10	10.50		
11	12.91		
12	12.95		
13	13.14		
14	10.68		
Average....	11.71		9.70

* A composite sample of a number of ears.

It is undoubtedly a slow matter to improve the feeding quality of corn by selection and breeding. That it can be done, however, seems to have been demonstrated. It will surely prove a boon to feeders of young stock and dairy cattle if the nutritive ratio of corn can be changed from 1:10 to 1:7 or 1:8, and this at present seems to be among the possibilities. What effect, if any, this may have upon the productiveness of the corn plant is not yet fully determined.

DESCRIPTION OF VARIETIES.

Among the many varieties grown in our plot work during the past ten years, twenty-eight have been selected for careful description. Most of these varieties have been measured by the writer but some few not now in stock have been described after Bulletin 57 of the office of Experiment Station, U. S. Department of Agriculture.

The following terms are used in describing the characteristics of the varieties considered.

Shape of Ear: Cylindrical; slowly tapering; tapering; very tapering.

Butt: Even, butt end of cob bare. Rounding—kernels following a rounded cob, and described as shallow, moderately and deeply rounding. Compressed—a slight decrease in diameter of cob at butt. Enlarged—an increase in diameter, but no extra rows; instead, open space between rows. Expanded—large butt caused by extra rows. Depressed—kernels flattened at butt, short.

Space: Space, or furrows between rows described as narrow, medium and wide.

Tips: Regular, kernels in rows clear to the tip. Irregular—kernels irregular at tip.

Kernel: Long wedge; medium wedge; rectangular—as broad at base as at summit.

Indentation: Round; long; crease-dented—edges pressed toward each other; pinched-dented, edges pinched close.

The other terms used hardly need explanation. The circumference of the ear is measured three inches from the butt.

Very many of the varieties described herewith do not mature at the Station. Mention is made as to maturity. It is probable that very many which do not quite mature would do so if they were to be grown for a few years from Station grown seed. Buying the seed new each year there is small chance for acclimatization.

The varieties follow:

Bristol 100-day.—Ear slowly tapering; shallow-rounding at butt; length, 8 to 10 inches; circumference 6¼ in.; 10 to 12-rowed; space between rows medium. Kernels loose, 7-16 in. broad; rectangular; crease-dented; light yellow with creamy-white cap. Shank large. Cob white or red. Has matured 3 years out 8.

Bloody Butcher.—Ear tapering; shallow-rounding at butt; compressed; length, 8½ to 9½ in., circumference 7¼ in.; 14 to 18-rowed; medium space. Kernels firm, ⅜ in. broad, ½ in. deep; long dented, sometimes rough; blood red. Shank large. Cob red. Does not mature here.

Cloud's Early Dent.—Ear very tapering; even at butt; length, 9 to 10 inches; circumference 8 inches; 24-rowed, not distinct. Kernels loose, ¼ in. broad, ½ in. deep; very pointed; tip irregular; crease-dented; light yellow. Shank large. Cob red. Does not mature here.

Clarage.—Slowly tapering; deeply rounding at butt; compressed; length 8½ to 9 inches; circumference 6¾ to 7½ in.; 14 to 20-rowed; regular rows at tip; medium space. Kernels firm, 5-16 in. broad, 9-16 in. deep; medium wedge; crease-dented; medium rough; deep yellow. Shank small. Cob medium. red. Matures here.

Chester County Mammoth.—Ear tapering; shallow-rounding at butt; length 8 to 9 inches; circumference 8 inches; 20 to 24-rowed, not distinct; tips irregular. Kernels firm, 5-16 in. broad, ⅝ in. deep; rectangular; crease-dented; very light yellow with cream cap. Shank medium. Cob red. Does not mature here.

Champion Early White Pearl.—Ear tapering; medium rounding; enlarged at butt; 9 to 10 inches long; circumference 7½ inches; 14 to 16-rowed; space between rows narrow; irregular rows at tip. Kernels firm, ⅜ in. broad, ½ in. deep; rectangular; crease-dented; rough; white. Shank small. Cob white. Does not mature here.

Cary's Gold Coin.—Ear tapering; shallow rounding at butt; compressed; length 8 to 9 inches; circumference 7 inches; 18 to 22-rowed, space between rows narrow; irregular rows at tip. Kernels firm, ¼ in. broad, ½ in. deep; long wedge; long-dented; yellow. Shank large. Cob red. Has matured one year out of four here.

Darke County Early Mammoth.—Ear slightly tapering; moderately rounding; compressed at butt; length 9 to 9½ inches; circumference 7½ inches; 16 to 20-rowed; space between rows narrow; regular rows at tip. Kernels firm, 5-16 in. broad, ½ in. deep; medium wedge; yellow; crease-dented. Shank medium. Cob red. Has matured one year in six.

Early Butler.—Ear slowly tapering; shallow rounding; compressed; length, 7½ to 8 inches; circumference 6 inches; 16-rowed; space narrow; irregular rows at tip. Kernels firm, nearly 5-16 in. broad, strong 7-16 in. deep; medium wedge; long-dented; medium smooth; yellow. Shank medium. Cob red. Has matured here nine years out of ten.

Early Huron Dent.—Ear slowly tapering; more quickly in tip portion; moderately rounding at butt; compressed; length 7 to 7½ inches; circumference 6¼ in.; 12 to 16-rowed; space narrow; regular rows at tip. Kernels firm, ¼ in. broad, 7-16 in. deep; wedge shape; yellow; crease-dented. Shank small. Cob red. Has matured eight years out of nine.

Early Mastodon.—Ear tapering; shallow rounding at butt; length 8 to 9½ in.; circumference 7½ inches; 16 24-rowed; space narrow; regular rows at tip. Kernels loose, 5-16 in broad, ½ in. deep; medium wedge shape; pinched-dented; dark yellow with cream yellow cap. Shank large; Cob red. Does not mature here.

Early White Dawn.—Ear slowly tapering; moderately rounding at butt; compressed; length 7½ inches; circumference 6½ inches; 14-rowed; space wide; irregular rows at tip. Kernels loose, ⅜ in. broad, ½ in. deep; medium wedge; crease-dented; white. Shank medium. Cob white. Has matured two years ont of seven.

Golden Beauty.—Ear slowly tapering; even at butt; expanded; length 9 to 10 inches; circumference 7¼ incher; 12 to 14-rowed; space medium; regular rows at tip. Kernels loose, 7-16 in. broad, ½ in. deep; broad at base; crease-dented; medium smooth; yellow. Shank large. Cob pink. Does not mature here.

Golden Dent.—Ear cylindrical; shallow rounding at butt; enlarged; length 9½ inches; circumference 7¼ ihches; 16 to 20-rowed; space medium; irregular rows at tips. Kernels loose, scant 5-16 in. broad, 9-16 in. deep; long wedge; crease-dented; rough; yellow. Shank large. Cob red. Has matured two years out of ten.

Hickory King.—Ear slowly tapering; shallow rounding at butt; depressed; length 7 inches; circumference 5½ in.; 10-rowed; space wide; regular at tip. Kernels firm, 3-8 in. broad, 7-16 in. deea; broad wedge; long-dented; medium smooth; white. Shank medium. Cob white. Does not mature here.

Henderson's Eureka.—Ear slowly tapering; moderately rounding at butt; expanded; length 9 to 10 inches; circumference 7½ inches; 16-rowed; space between rows medium; regular rows at tip. Kernels loose, ⅜ in. broad, ½ in. deep; broad at base; long-dented; slightly rough: dark yellow. Shank medium large. Cob red. Has not matured here.

Iowa Gold Mine.—Ear tapering; moderately rounding at butt; slightly compressed; length 7½ to 8½ inches; circumference 6¾ inches; 16 to 18-rowed; space between rows medium; irregular at tip. Kernels loose 5-16 in. broad, 9-16 in. deep; long-wedge; pinched-dented; very rough; yellow. Shank small. Cob red. Has matured one year in eight here.

Iowa Silver Mine.—Ear slowly tapering; shallow rounding at butt; depressed; length 8½ to 9 inches; circumference 7 inches; 14 to 16-rowed; space narrow; regular at tip. Kernels firm, 3-8 in. broad, 7-16 in. deep; broad at base; crease-dented; rough; white. Shank menium. Cob white. Has not matured here.

King of the Earliest.—Ear slowly tapering; deeply ronnding at butt; length, 6½ to 7½ inches; circumference 6½ inches; 14 to 16-rowed; space narrow; irregular at tip. Kernels firm, scant 5-16 in. broad, 1-2 in. deep; medium wedge shape; pinched-dented; rough; yellow. Shank small. Cob red. Has matured eight years out or nine here.

Leaming.—Ear tapering; moderately rounding at butt; expanded; length 8½ to 10 inches; circumference 7 to 7½ inches; 16 to 20-rowed; medium space between rows; irregular tip. Kernels firm, 5-16 in. broad, 1-2 in. deep; medium wedge; round-dented; (sometimes rough) deep yellow. Shank large. Cob medium large, red. Has matured here three years out of four.

Leaming Cuppy.—Ear tapering; moderately rounding; enlarged; length 8½ to 9½ inches; circumference 7 inches; 14 to 16-rowed; space narrow; irregular tip. Kernels firm, 5-16 in. broad, 1-2 in. deep; wedge shape; round-dented; yellow. Shank medium. Cob red. Has matured four out of five years.

Murdock 90-day.—Ear tapering; shallow rounding; a little enlarged at butt; length 7½ to 9 inches; circumference 6½ inches; 14-rowed; space rather wide. Kernels loose, 3-8 in. broad, 1-2 in. deep; broad at base; long-dimple-dented; yellow. Shank medium. Cob red. Has matured three years out of four.

Minnesota King.—Ear slowly tapering; even at butt; depressed and frequently enlarged; length 8½ to 9½ inches; circumference 6 inches; 8 to 12-rowed; space wide; regular tip. Kernels loose, 7-16 in. broad, 7-16 in. deep; broad at base; crease-dented; light yellow. Shank large. Cob white. Has matured seven years out of nine.

New Golden Surprise.—Ear tapering at tip; shallow rounding at butt; length, 8½ to 9 inches; circumference 7 inches; 14 to 18-rowed; space wide; irregular rows at tip. Kernels loose, 5-16 in. broad, 9-16 in. deep; long wedge; crease-dented; medium rough; dark yellow. Shank mall. Cob red. Has matured two years out of five.

Pride of the North.—Ear slowly tapering; moderately rounding at butt; length 7 to 8 inches; circumference 6¼ inches; 14 to 16-rowed; space narrow; irregular rows at tip. Kernels loose, 5-16 in. broad, 7-16 in. deep; wedge shape; crease-dented; medium rough; yellow. Shank medium. Cob red. Has matured seven years out of eight.

***Riley's Favorite.**—Ear slowly tapering; moderately rounding at butt; compressed; length 9 inches; circumference 7 inches; 16 to 20-rowed; space medium; regular rows at tip. Kernels firm upright medium wedge; roughly dented; deep yellow. Shank small. Cob small, deep red. Percent of grain 90. It has matured one year out of two here.

***Reid's Yellow Dent.**—Ear slowly tapering; deeply rounding at butt; compressed; length 10 inches; circumference 7 inches; 18 to 24-rowed; space narrow; regular rows at tip. Kernels firm, upright; long-wedge; medium smooth dented; light yellow. Shank small. Cob medium, deep red. Percent of grain 88. It has not matured here.

White Cap Yellow Dent.—Ear slightly tapering; moderately rounding at butt; length 8½ to 9 inches; circumference 7 inches; 14 to 16-rowed; space narrow; irregular rows a tip. Kernels firm, 5-16 in. broad, 1-2 in. deep; wedge shape; crease-dented, medium rough; light yellow with white cap. Shank medium. Cob white. It has matured every year.

*Standard adopted by Illinois Corn-Grower's Association.

FIELD EXPERIMENTS.

These experiments were conducted by the late J. Fremont Hickman and the report which follows is based upon careful records kept by him. They consist of cultural work and a comparative test of varieties.

DRILL OR HILL PLANTING?

A question often asked but not easily answered for the reason that its solution does not depend entirely upon the matter of yield. The experiments reported represent four seasons' work, beginning in 1894. Table II gives the results of this work. The first column shows the number of plots grown each year at the different distances.

CORN TABLE II.—DRILLING VS HILL PLANTING.

Distribution of seed.	No. of plots	Yield per acre.		Percent	
		Grain	Stover	Of ears.	Of nub's
1894		Bushels	Pounds	Percent	Percent
One grain every 12 inches.	2	44.21	2144	51	49
One grain every 18 inches.	2	39.12	1936	65	35
Two grains every 24 inches.	2	41.19	2017	40	60
Three grains every 36 inches.	1	39.60	1851	46	54
Four grains every 42 inches.	1	38.38	1961	34	66
Four grains every 48 inches.	1	39.90	1758	42	58
1895					
One grain every 12 inches.	2	52.97	2821	63	37
One grain every 18 inches.	2	40.45	1989	72	28
Two grains every 24 inches.	2	54.94	2526	65	35
Three grains every 36 inches.	1	45.01	2278	55	40
Four grains every 42 inches.	1	48.35	2560	49	51
Four grains every 48 inches.	1	50.46	2625	56	44
1896					
One grain every 12 inches.	2	43.45	2689	95	5
One grain every 18 inches.	2	30.30	2763	94	6
Two grains every 24 inches.	2	42.72	2707	93	7
Three grains every 36 inches.	2	42.39	2375	93	7
Four grains every 42 inches.	2	41.68	2161	89	11
Four grains every 48 inches.	2	38.19	2157	90	10
1897					
One grain every 12 inches.	3	33.28	2460	62	38
Two grains every 24 inches.	3	33.72	2523	58	42
Three grains every 36 inches.	2	31.76	2175	55	45
Four grains every 42 inches.	2	29.84	2320	52	48

AVERAGE YIELDS FOR FOUR YEARS FROM DIFFERENT DISTRIBUTION OF SEED

Distribution of seed	1894	1895	1896	1897	4-year Average		Ears & nub's	
					Grain	Stover	Ears	Nub's
	Bushels	Bushels	Bushels	Bushels	Bushels	Pounds	Perc't	Perc't
One grain every 12 inches.	44.21	52.97	43.45	33.28	43·47	2528	68	32
One grain every 18 inches.	39.12	40.45	30.30	.....	36.62	2229	77	23
Two grains every 24 inches.	41.19	54.94	42.72	33.72	43.14	2443	64	37
Three grains every 36 inches.	39.60	45.01	42.39	31.76	39.69	2169	62	36
Four grains every 42 inches.	38.38	48.35	41.68	29.84	39.56	2250	56	44
Four grains every 48 inches.	39.90	50.46	38.19	.....	42.85	2180	63	37

Taking up this average for the four years, one grain every 12 inches has given a little the best yield, and as compared with its nearest competitor in yield, the larger per cent of ears.

One grain every 18 inches gives the largest per cent of ears but the yield shows that this distance is too far apart for single grains.

Two grains every 24 inches gives practically the same yield as one grain every 12 inches, but with a larger per cent of nubbins.

Attention is called to the fact that two of these tests were dropped the last year and their average is only for *three* years, which gives them an advantage, as the fourth year was a poor corn year and cuts down the average for the other plots about 3 bushels.

Four grains every 42 inches gives the largest per cent of nubbins of all and is evidently too thick seeding.

It would seem from this experiment that, other things being equal, corn planted in drills with grains 12 inches apart will give the largest yield and the most marketable corn. For land reasonably free from weeds it will likely give the best results. In weedy bottom lands, however, it is questionable if drilling will prove satisfactory.

DEEP VS. SHALLOW CULTIVATION.

Experiments testing the comparative merits of deep and shallow cultivation have been carried on during nine seasons.* For deep cultivation the double shovel has been used, working the ground to a depth of four inches or a little more. For shallow working a spring tooth cultivator has been used and the ground stirred to a depth of an inch and a half. Table III gives the results of these experiments.

Taking each year's test by itself it will be noticed that without a single exception shallow cultivation has given a larger yield of grain, regardless of weather conditions. One season, it is true, the increase is of little moment.

With the exception of one season the yield of stover is larger from the shallow cultivation.

Taking the average for the nine seasons' work shallow cultivation leads in yield of grain by exactly four bushels per acre, and in stover by over two hundred pounds per acre.

This matter of deep and shallow cultivation would seem to be pretty well settled. It has been tested at many different Experiment Stations and the results have been quite in line with the work herewith reported.

*In 1891 and 1892 these tests were made on the farm of the Ohio State University at Columbus. Since then they have been made here.

CORN TABLE III.—DEEP VS. SHALLOW CULTIVATION.

YEAR.	Cultivation.	Implement used.	Depth of cultivation.	No. of dup. plots	Average yield per acre.		Barren stalks.	Weight of ears.
					Grain	Stover		
			Inches	Number	Bush.	Lbs.	Number	Lbs.
1891	Deep	Double shovel	....	3	77.4	3250	....	....
	Shallow	Spring-tooth cultivator	....	3	86.5	3376	....	....
*1891	Deep	Double shovel	....	3	76.8	3073	....	....
	Shallow	Spring-tooth cultivator	....	3	85.0	3216	....	....
1892	Deep	Double shovel	4	4	73.8	3235	35	....
	Shallow	Spring-tooth cultivator	1½	4	77.1	3332	34	....
1895	Deep	Double shovel	4	3	59.5	3582	78	.4268
	Shallow	Spring-tooth cultivator	1½	3	61.6	3928	78	.4693
1896	Deep	Double shovel	4	2	58.5	3792	20	.4267
	Shallow	Spring-tooth cultivator	1½	2	66.0	4462	29	.4813
1897	Deep	Double shovel	4	1	35.2	1280	....	.4201
	Shallow	Spring-tooth cultivator	1½	2	37.3	1335	....	.4717
1898	Deep	Double shovel	4	3	58.3	2520	55	.5417
	Shallow	Spring-tooth cultivator	1½	3	58.5	2520	53	.5681
1899	Deep	Double shovel	4	5	34.9	1818	26	.5814
	Shallow	Spring-tooth cultivator	1½	3	37.0	2100	33	.5681
1900	Deep	Double 3hovel	4	5	56.4	2474	24	.5952
	Shallow	Spring-tooth cultivator	1½	3	58.6	2590	20	.5319
1901	Deep	Double shavel	4	5	33.2	1590	21	.5524
	Shallow	Spring-tooth cultivator	1½	5	36.1	1884	24	.5154
Average from deep cultivation 9 years			....	34	56.4	2661	....	....
Average from shallow cultivation 9 years			....	31	60.4	2874	....	....

* Duplicate series.

The depth of cultivation evidently has little or no effect upon the number of barren stalks nor upon the weight of ears.

THE METEOROLOGICAL RECORD.

The corn crop would be an uncertain quantity with the factors heat and moisture left out. The tables which follow tell the story:

CORN TABLE IV.—MEAN TEMPERATURE AT THE STATION FOR THE FIVE MONTHS OF THE CORN SEASON FOR FIFTEEN YEARS.*

MONTH.	1888	1889	1890	1891	1892	1893	1894	1895	1896	1897	1898	1899	1900	1901	1902
	Deg.	Deg.	Deg.	Deg.	Deg.	Deg.	Deg.	Deg.	Deg.	Deg.	Deg.	Deg.	Deg.	Deg.	Deg.
April	46.3	50.7	52.6	52.0	50.0	50.1	50.5	49.5	54.6	47.2	45.3	52.1	47.8	45.2	46.2
May	60.1	60.6	59.3	57.0	60.0	57.6	57.5	59.4	64.5	53.4	58.2	60.0	61.5	57.9	61.4
June	71.1	67 1	73.4	71.0	73.0	69.3	67.9	69.9	65.6	64.3	68.7	69.4	68.5	69.1	65.6
July	72.8	73.0	72.9	69.0	73.0	72.0	71.4	68.6	70.2	73.2	74.5	70.0	72.6	75.9	73.0
August	70.9	68.8	68.5	70.0	71.0	67.9	69.2	70.9	68.5	67.0	71.1	71.0	74.0	71.6	66.4

CORN TABLE V.—RAINFALL ON THE STATION FARM FOR THE FIVE MONTHS OF THE CORN SEASON FOR FIFTEEN YEARS.

MONTH	1888	1889	1890	1891	1892	1893	1894	1895	1896	1897	1898	1899	1900	1901	1902
	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches
April	2.39	1.11	4.08	2.02	2.63	5.66	1.74	1.69	3.34	2.75	2.56	1.28	1.70	2.46	1.46
May	6.67	3.46	4.69	2.87	4.63	6.28	4.41	1.38	3.41	4.97	4.60	4.42	2.23	4.32	2.57
June	2.43	2.08	5.43	3.83	6.73	2.51	2.23	4.20	3.98	2.98	2.70	1.95	3.71	4.82	5.55
July	4.72	2.85	1.41	4.41	3.13	1.38	1.38	2.19	8.05	3.89	6.79	3.73	5.65	3.32	5.26
August	5.85	2.07	2.71	1.84	6.15	1.53	0.76	2.30	1.96	3.86	5.53	0.53	5.97	3.58	1.87
Total	22.06	11.57	18.32	14.97	23.27	17.36	10.52	11.76	20.74	18.45	22.18	11.91	19.26	18.50	16.71

* At Columbus previous to 1893, at Wooster 1893 and since.

COMPARATIVE TEST OF VARIETIES.

Of all our cereals there is none with which a comparative test of varieties is as unsatisfactory as with corn. In such a test, if it be of any value, the plots must be grown side by side, and in this event cross fertilization will necessitate the purchase of new seed corn each year, for of course it is impossible to separate very many varieties sufficiently to grow unmixed seed in other locations. When it comes to purchasing the new seed each year one soon discovers how difficult it is to find seed about which he can learn very much. With the exception of one variety, the Clarage, which has been used on every third plot as a standard with which to compare all other varieties in our plot work, all seed has been purchased each year and, except in a few instances, neither the grower nor the locality in which the seed was grown has been known.

Under such conditions it is impossible to make any very satisfactory comparisons. These conditions have been seemingly unavoidable, at least until very recently. It is impossible, even at the present time, to secure very many varieties that have been bred with care.

The Station has tested in the neighborhood of one hundred varieties during the last twelve years. Many of these varieties have dropped out and are no longer offered for sale by our seedsmen. Many of them have been tested only a year or two, and for the reason that they were no longer advertised. Some of them have been dropped as of little value. Of many supposedly new varieties the only thing that can properly be said to be new has been the name, for the extravagant superlatives heralding their introduction have become decidedly familiar. In view of these facts it has seemed best to include only 47 varieties in the following report.

Table VI names these varies and the number of years each has been tested; the number of years they have matured; the average increase or decrease in yield as compared with the standard for the whole number of years tested, both in grain and stover; the shrinkage in drying; the weight per shelled bushel; the number of ears in 100 pounds of (ear) corn; the pounds of cobs per bushel of grain; the pounds of stover per bushel of grain.

In taking up the matter of maturity, it should be stated that the latitude of the Station is 40° 47′; elevation, 1050 feet. The following varieties have matured every year, or in some instances every year except 1902, when they were marked 95 per cent maturity.

(1902 will be remembered as very unfavorable to maturity): Clarage, Early Butler, Early Huron Dent, King of the Earliest, Pride of the North, White Cap Yellow Dent.

CORN TABLE VI.—COMPARATIVE TEST OF VARIETIES.

VARIETY.	Years tested	Years matured	Average increase (+) or decrease (—) per acre		Shrinkage in drying	Weight per shelled bu.	Ears in 100 lbs.	Per bushel. grain of	
			Grain	Stover				Cobs	Stover
		Bus.	Lbs.	Lbs.	Percent	Lbs.	No	Lbs.	Lbs.
Big Buckeye	2	0	— 3.02	+ 501	..	.....	...	.....	104.2
Bristol 100-day	8	3	+ 9.43	+1180	22	52.71	154	10.36	59.5
Bloody Butcher	2	0	+ .57	+ 239	26	45.50	131	10.85	56.6
Cloud's Early Dent	7	0	+ 8.03	+ 948	27	47.08	136	8.05	57.7
Chester Co. Mammoth	7	0	+ 8.31	+1064	21	48.41	130	8.26	55.0
Champion Early White Pearl	10	0	+ .95	+ 278	21	49.82	165	12.67	62.3
Cary's Gold Coin	4	1	+ 7.27	+ 417	17	51.62	158	9.59	47.2
Dungan's White Prolific	4	0	+ 4.76	+1729	20	52.25	159	10.64	83.8
Darke Co. Early Mammoth	6	1	+10.35	+ 632	20	53.16	149	9.94	49.8
Dr. Woodhull	5	1	+ 8.15	+ 534	22	54.62	121	10.50	63.5
Early Mastodon	9	0	+ 7.44	+ 773	20	52.21	140	9.45	58.8
Early Butler	10	9	— 4.45	— 542	9	54.50	231	8.33	44.3
Early Colossal	3	1	+ 7.27	+ 882	27	52.50	136	5.25	56.0
Early Huron Dent	9	8	— 3.37	— 291	13	53.41	215	9.45	48.4
Eclipse	5	1	+ 7.54	+1393	25	50.41	152	8.26	67.5
Early Giant White Dent	2	1	— 6.35	— 147	..	.....	...	.....	47.2
Early White Dawn	7	2	+ 5.11	+ 463	17	52.78	180	9.66	50.3
Farmer's Favorite	3	0	+15.01	+ 298	28	51.75	127	8.89	59.2
Forsythe's Favorite	4	0	+ 2.49	+2003	29	47.50	143	10.64	87.8
Golden Beauty	8	0	+ 1.72	+1948	23	50.87	146	10.15	85.7
Golden Dent	10	2	+ 9.26	+1143	24	49.25	134	9.45	62.6
Hess White	4	3	+ 3.12	+ 275	..	.....	...	.....	50.3
Hickory King	8	0	— .07	+1389	21	51.40	194	8.89	79.0
Henderson's Eureka	3	0	+15.15	+ 728	21	51.58	119	10.92	58.2
Iowa Gold Mine	8	1	+ 2.08	+ 224	16	51.61	171	8.54	50.5
Iowa Silver Mine	6	0	+ 1.67	+ 646	20	50.62	150	9.38	51.6
Improved Leaming	3	0	+ 2.02	+ 263	17	53.25	171	10.22	53.2
King of the Earliest	9	8	— 9.43	— 544	10	54.29	241	8.75	47.4
Leaming	4	3	+10.06	+ 405	19	55.25	138	9.45	50.4
Leaming Cuppy	5	4	+ 7.45	+ 595	15	54.	161	10.22	52.2
Mortgage Lifter	5	2	+ 2.76	+ 676	13	53.50	146	8.05	60.6
Mammoth White Dent	9	0	+ 3.11	+ 722	20	52.69	138	10.36	68.0
Mammoth White Surprise	5	0	— 6.56	+2932	37	44.50	165	10.85	153.0
Murdock's 90 day	4	3	— 2.59	— 345	13	54.12	162	8.40	43.0
Minnesota King	9	7	—12.19	— 586	12	53.	209	11.27	45.4
Mammoth Golden Dent	2	0	+ 4.07	+ 604	20	50.	123	8.54	49.1
McCormick	2	0	+ 2.01	+ 85	21	50.50	163	7.00	48.8
Missouri Leaming	1	0	+23.24	+1680	16	48.50	120	7.25	55.0
New Golden Surprise	5	2	— 1.55	— 109	13	51.40	173	7.35	45.1
Pride of the North	8	7	—11.04	— 502	9	54.87	245	8.61	50.3
Plant Seed Company	2	0	+ 4.70	+1150	24	51.62	137	9.45	63.9
Riley's Improved Favorite	2	1	+ 1.04	+ 977	..	.....	...	.....	80.0
Reid's Yellow Dent	2	0	+16.33	+1068	27	49.	141	9.80	52.2
St. Charles White	6	0	+ 1.30	+1943	26	50.06	135	8.47	84.5
White Cap Yellow Dent	7	7	+ 2.41	+ 104	12	54.37	178	9.94	47.4
Wisconsin White Dent	10	5	— .64	— 91	15	51.82	172	10.78	48.6
Clarage	10	9			14	53.79	182	7.37	50.6

The following varieties have matured every year but one (no counting 1902): Hess White, Leaming, Leaming Cuppy, Minnesota King, Murdock's 90 Day.

Twenty-two of the forty-seven varieties have in no season completely matured.

The per cent of shrinkage in drying as given in column 4 is at fairly accurate index to the state of maturity of the different varieties.

As to yield: 34 of the 47 varieties are found to be above the standard and 12 varieties below. Only 15 varieties of the 34 above the standard have ever matured at the Station, and only 8 of the 15 have matured more than one year, and only 5 more than two years.

The six highest yielders stand in the following order: Missouri Leaming, Reid's Yellow Dent, Henderson's Eureka, Farmer's Favorite, Darke Co. Early Mammoth and Leaming.

The Missouri Leaming is simply a western type of Leaming, grown in Illinois but sent to this Station by the Missouri Station in an arrangement between the two Stations to study the effect of soil and climate upon corn. Starting with identical seed the thought is to follow it up a few years and note the changes in the characteristics of the variety. It has been grown but one season.

Reid's Yellow Dent, which stands second, is a very popular Western variety (originating in Ohio, however) and will undoubtedly prove a very valuable corn for the southern half of the state. It has been tested only two years at the Station. It will not mature here at present but I see no reason why it may not gradually be pushed to the northward with advantage.

Henderson's Eureka stands third in yield. It appears to be a valuable variety of the large type but it needs further testing. It is by no means as well established a variety as the preceding.

Farmer's Favorite, fourth in yield, was tested three seasons, the last being six years ago.

Darke Co. Early Mammoth, fifth in point of yield, is a promising variety that has been tested six seasons.

Leaming, rated sixth, is of a somewhat smaller type than the Western Leaming, rated first, although near of kin. The Leaming is perhaps the oldest distinct variety of corn which we have, dating back to 1826, and is likely the best established of any variety of corn. Judging from reports received from the leading corn growers in all sections of our State, except the northeastern, it is certainly a great favorite.

These represent the larger varieties.

CORN TABLE VII.—Comparative test of varieties.

Yield in bushels per acre.

VARIETY.	1893	1894	1895	1896	1897	1898	1899	1900	1901	1902
Big Buckeye	27.22	.....	34.42	.....	.....	.....	.....	.....	.....	.....
Bristol 100-day	.....	*33.42	50.33	106.46	45.93	69.25	52.78	61.51	41.47	.....
Bloody Butcher	.....	.....	.....	.....	.....	.....	.....	.....	†58.44	†53.05
Cloud's Early Dent	22.07	.....	.....	99.10	50.78	*65.82	*50.30	†49.05	44.66	.....
Chester Co. Mammoth	26.64	.....	.....	98.71	.....	*65.18	*49.43	†65.87	51.40	†62.19
Champion Early White Pearl	22.43	31.85	40.17	101.03	16.78	*47.53	*43.44	†55.91	†45.72	†52.49
Cary's Gold Coin	.....	.....	.....	.....	.....	.....	*51.03	†54.71	†48.06	†80.62
Dungan's White Prolific	13.64	*29.62	52.28	100.21	29.07	.....	.....	.....	.....	.....
Darke Co. Early Mammoth	.....	.....	.....	.....	43.39	71.93	*49.21	†57.67	†54.76	†80.41
Dr. Woodhull	*25.64	46.00	*52.28	103.37	.....	.....	.....	†45.58	.....	.....
Early Mastodon	*27.46	36.21	63.18	.....	59.82	*63.53	*52.35	†62.67	†61.26	†66.42
Early Butler	27.43	27.85	46.25	*64.16	34.94	*38.14	*33.49	†50.74	†42.92	†46.38
Early Colossal	.....	29.03	61.68	83.21	.....	.....	.....	.....	.....	.....
Early Huron Dent	27.57	28.89	44.21	108.53	*27.23	*36.92	.....	†41.99	†36.51	45.90
Eclipse	.....	33.14	52.07	97.96	50.43	*60.48	.....	.....	.....	.....
Early Giant White Dent	.....	29.25	46.28	.....	.....	.....	.....	.....	.....	.....
Early White Dawn	.....	.....	.....	80.96	28.21	*63.30	*48 07	†64.39	†58.87	†58.33
Farmer's Favorite	24.57	.....	.....	*95.03	62.32	.....	.....	.....	.....	.....
Forsythe's Favorite	.....	29.17	54.28	78.22	33.07	.....	.....	.....	.....	.....
Golden Beauty	.....	38.71	55.39	.....	45.07	*63.85	*48.72	†61.94	31.40	†69.69
Golden Dent	26.07	28.21	58.85	99.90	56.89	*74.35	*49.19	†70.31	†68.54	†65.80
Hess White	19.34	*28.48	31.78	90.10	.....	.....	.....	.....	.....	.....
Hickory King	.....	.....	45.57	70.71	20.98	*45.21	*36·46	†59.28	34.60	63.64
Henderson's Eureka	.....	.....	.....	.....	.....	.....	.....	†56.48	†66.44	†79.94
Iowa Gold Mine	30.50	.....	.....	72.85	59.43	*50.01	40.64	†56.17	†46.67	†67.35
Iowa Silver Mine	.....	.....	.....	79.60	.....	*56.49	*42.11	†50.01	†54.23	†57.21
Improved Leaming	.....	.....	.....	.....	*41.74	*49.10	*46.37	.....	.....	.....
King of the Earliest	.....	26.92	44.46	58.28	*29.32	*38.91	*35.67	†45.10	†32.39	†54.57
Leaming	.....	*34.24	*46.81	*96.00	53.35	.....	.....	.....	.....	.....
Leaming Cuppy	.....	.....	.....	.....	35.96	*57.66	*46.94	†60.82	†55.56	.....
Mortgage Lifter	21.93	35.60	48.50	35.00	.....	.....	.....	†52.51	.....	.....
Mammoth White Dent	15.43	37.85	44.14	.....	28.39	*63.99	*49.01	†52.65	†55.76	†57.37
Mammoth White Surprise	10.35	28.67	40.85	76.75	15.14	.....	.....	.....	.....	.....
Murdock's 90-day	.....	23.10	27.92	93.18	.....	.....	.....	†46.67	.....	.....
Minnesota King	.....	22.64	30.68	62.23	24.32	*39.71	*35.41	†36.69	†37.69	†46.98
Mammoth Golden Dent	.....	.....	.....	.....	.....	.....	*48.21	†64.23	.....	.....
McCormick	.....	.....	.....	.....	.....	.....	.....	.....	†50.67	†56.51
Missouri Leaming	.....	.....	.....	.....	.....	.....	.....	.....	.....	92.64
New Golden Surprise	.....	.....	.....	.....	.....	*47.44	†41.53	†46.75	†44.15	†63.06
Pride of the North	.....	23.14	32.18	*59.51	26.39	35.41	†37.32	.....	31.25	49.53
Plant Seed Company	.....	.....	.....	.....	.....	.....	.....	†56.72	†51.71	.....
Riley's Improved Favorite	.....	*27.28	58.99	.....	.....	.....	.....	.....	.....	.....
Reid's Yellow Dent	.....	.....	.....	.....	.....	.....	.....	.....	†64.32	†75.35
St. Charles White	.....	30.07	39.85	98.85	18.46	*61.03	†39.76	.....	.....	.....
White Cap Yellow Dent	.....	.....	47.57	72.25	*29.21	.....	†41.90	†49.25	†42.28	†78.53
Wisconsin White Dent	16.14	21.14	35.38	76.57	32.07	*67.28	†46.16	†62.65	†51.79	†49.56
Clarage (not included in ave.	26.29	30.26	47.98	71.12	37.82	49.26	54.53	45.52	47.99	58.63
Average of all varieties	22.61	30.42	45.98	84.24	36.99	55.52	44.62	54.94	48.69	62.94

* † The average of duplicate plots.

Of the medium, the Clarage is perhaps easily first. Adapted to this soil and climate, we have used it as the standard. The Leaming Cuppy is worthy of mention in this clas,s and especially is the White Cap Yellow Dent to be included. The latter bears the distinction of being the only variety that has matured every season and exceeded the standard in yield.

Of the Early varieties the Pride of the North, King of the Earliest, Early Butler and Extra Early Huron Dent should be mentioned. The latter is perhaps the earliest.

The last five colums of Table VI carry much information. They tell of the size of the variety and whether it be out of its latitude or not.

Table VII gives the yield in bushels per acre. It is not a safe guide as between the different varieties. Its chief value is as an index to the seasons, as shown by the averages at the bottom of the table.

SUMMARY.

SELECTING SEED.

1 In selecting seed corn the aim should be to choose thoroughly matured ears of medium size, uniform in type, cylindrical or slowly tapering in shape, with a large number of straight, closely-set rows rounding at butt and running clear to tip with kernels medium to long wedge in shape and rough dented. And for the reason that this is the sort of ear that will yield the most shelled corn.

2 The seed thus selected should be thoroughly cured, using artificial heat.

3 The corn grower should have his special seed plot and from it the barren stalk, which is more than half a weed, should be banished (tassel pulled) before it has fertilized the fruitful plant.

CULTURAL WORK.

1 Corn planted with one grain every 12 inches has given a larger yield and a larger per cent of sound ears than when planted two grains every 24 inches, three grains every 36, or four grains every 48 inches, the rows being 42 inches apart in each instance.

2 Nine seasons' testing of deep as compared with shallow cultivation has shown an increase in yield in favor of shallow each season, with an average increase of four bushels per acre for the entire period.

VARIETIES OF CORN ADAPTED TO DIFFERENT PARTS OF OHIO.

I realize the fact that in naming varieties for the different parts of the State it is not a matter of latitude solely.

The warm, black soil of northwestern Ohio will mature a variety that will prove a disappointment in the same latitude in notheastern Ohio. However it is more convenient to divide the State in this way and so I say that for south of the 40th parallel (Columbus is on this parallel) Leaming and Reid's Yellŏw Dent are suggested.

Between the 40th and 41st, Leaming and Clarage. North of the 41st, Clarage and White Cap Yellow Dent, with possibly Early Huron Dent for the extremenortheast corner of the State. Where the White Cap Yellow Dent will mature—and I hardly think it will fail anvwhere in the State—it will prove superior to the Early Huron Dent.

I am suggesting but few varieties, and these of well known sorts for the reason that I am convinced that it is not so much new varieties that the corn grower of Ohio needs as more careful selection and breeding up of old and well tried varieties.